

Remarks

Interview

The Examiner is thanked for courtesies extended in granting an interview in the above captioned application to Dr. James Baker and Dale Bjorkman on April 14, 2005. During this interview, the history of advances in toner technology, particularly in the use of amphipathic copolymers in toners in the past and in currently pending patent applications, was discussed. The differences between copolymers prepared in aqueous media either as a suspension or emulsion polymerization reactions and amphipathic copolymers prepared in solvents as described in the present application were also discussed. The different development stages and toner discoveries for use in different printing processes were also discussed. Early systems were described having toner particles with very low Tg polymers that were imaged and adhesively transferred by an adhesive overlamine sheet. Liquid toners, including gels, were also discussed that comprised mid-range Tg toner particles that were formed as a film on the photoreceptor and transferred as a film and subsequently fused to a substrate. Phase change toner systems were also discussed, wherein a toner is provided in a system that is solid at room temperature, but which is converted to a liquid toner, for example by heating, prior to imaging. The imaging process in the phase change toner system thus is a liquid toner system.

Issues related to creation of dry toner particles from toner particles prepared in liquids, and issues related to printing from liquid toner compositions without film formation on the photoreceptor were also discussed.

Amendments

Claims 1, 12, 16, 17, 22, 23, 25 and 27 have been amended to insert language regarding the S and D material portions of the amphipathic copolymer. Antecedent basis for this amendment is found throughout the specification, for example at page 9, lines 5-14 and page 16, lines 17-27. Claims 1, 12 and 16 have additionally been amended to include the units for the Kauri-Butanol value. Upon entry of the present amendments, claims 1-29 will remain pending and under consideration in this application.

The specification has been amended to include Serial Number information for copending applications and to update the status of U.S. patent applications referenced in the specification. Additionally, the specification was amended to conform to the disclosure in original claim 5, as filed.

It is respectfully submitted that no new matter is introduced by these amendments.

Objections to the Specification

The Office Action states that the pending applications should be updated. This has been accomplished by the present amendment.

The Office Action additionally states that trademarks should be capitalized. In review of the specification, the undersigned believes that trademark usage is proper in this application. Specifically, the terms used on page 59 are capitalized, and additionally identified as trademarks by the TM or ® symbol. If the Examiner believes any correction is required, Applicants would appreciate indication of where in the specification such correction needs to be made.

Claim Rejections

Claims 1, 6, 10-17, 22, 23, 25 and 27 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite in the terms S and D. Claims 1, 12, 16, 17, 22, 23, 25 and 27 have been amended to relate the terms S and D to the carrier liquid. As claims 6, 10-11 and 13-15 are dependent from the amended claims, Applicants submit the amendments address the rejection of these claims as well. Applicants submit the rejection has been overcome.

Claims 2 and 18 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite based upon the assertion that “visual enhancements” should be a colorant particle. Applicants respectfully traverse this rejection. It is respectfully submitted that the full scope of this term would be understood to include more than a pigment particle. See page 33, line 12 through page 34, line 8 of the application. As described in the specification, the visual enhancement additive(s) generally may include any one or more fluid and/or particulate materials that provide a desired visual effect when toner particles

incorporating such materials are printed onto a receptor. Applicants request reconsideration and withdrawal of this rejection.

Claim 1 stands rejected under 35 U.S.C. §112, second paragraph, as being indefinite in that the Kauri-Butanol number should be in ml units. Claim 1 has been amended to include the units. Corresponding amendments have been made to claims 12 and 16. In light of the above, Applicants submit the rejection has been overcome.

Claim 5 stands rejected under 35 U.S.C. §112, second paragraph, as being indefinite for the use of the terms hexacontanyl and pentacosanyl. In response to this rejection, Applicants have amended the specification to conform to the claims originally filed in the application. See amendment to page 29 of the specification. The Office Action stated that the meaning of these terms is indefinite. Hexacontane is a known alkane that includes 60 carbon atoms ($C_{60}H_{122}$), and pentacosane is a known alkane that includes 25 carbon atoms ($C_{25}H_{52}$). Thus, upon removal of a hydrogen atom, these groups become hexacontyl and pentacosyl, respectively. Applicants request withdrawal of this rejection.

Claim Rejections - §103

Claims 1-29 stand rejected under 35 U.S.C. §103 as being unpatentable over Baker et al. (U.S. Patent No. 6,649,316) in view of Li et al. (U.S. Patent No. 6,103,781). For purposes of clarity, the patent numbers for the references cited in the outstanding rejection was confirmed via telephone call from the undersigned to the Examiner on January 26, 2005.

The present claims relate to liquid electrophotographic toner compositions having toner particles dispersed in a liquid carrier having a Kauri-Butanol number less than 30 ml. The toner particles are composed of polymeric binder comprising at least one amphipathic copolymer comprising one or more S material portions and one or more D material portions. The liquid toner compositions include one or more polymerizable, crystallizable compounds. The toner compositions as claimed are suitable for electrophotographic processes wherein the transfer of the image from the surface of a photoconductor to an intermediate transfer material or directly to a print medium is carried out without film formation on the photoconductor.

Regarding independent claims 1, 17, 23, 25, the claims recite liquid toner compositions, methods of making them, and methods of forming an image using such compositions, wherein one or more of the D material portions comprises one or more polymerizable, crystallizable compounds.

Regarding independent claims 12, 22, and 27, the claims recite liquid toner compositions, methods of making liquid toner compositions, and methods of forming an image using such compositions, wherein the D material portion has a T_g of greater than 55°C, and wherein one or more polymerizable, crystallizable compounds is included in the toner composition.

Regarding independent claim 16, the claim recites liquid toner compositions wherein the D material portion has a T_g in the range of 30-50°C, and wherein one or more polymerizable, crystallizable compounds is incorporated into the D material portion, or both the S material portion and the D material portion.

The toners as described herein, through the inclusion of one or more polymerizable, crystallizable compounds, surprisingly provide compositions that are particularly suitable for electrophotographic processes wherein the transfer of the image from the surface of a photoconductor to an intermediate transfer material or directly to a print medium is carried out without film formation on the photoconductor. The claimed toner compositions provide lower fusing temperatures, as compared to otherwise identical liquid toner particles that lack polymerizable crystallizable compounds chemically incorporated into the amphipathic copolymer.

Inclusion of the polymerizable, crystallizable compound in the D portion is not only technically surprising, but inclusion of the polymerizable, crystallizable compound in the D portion can provide surprising effects of the overall toner composition. Inclusion of the polymerizable, crystallizable compound in the D portion can provide an anti-blocking effect. This is surprising, since the D portion of the copolymer is not a crystallizable side chain and is therefore not as readily exposed to and solvated in the liquid carrier as the S portion of the copolymer. Further, it is unexpected that the S portion of the copolymer does not interfere with the anti-blocking benefit. It is also surprising that the polymerizable crystallizable compounds can be included in the D portion without adversely affecting properties of the amphipathic copolymer. The

polymerizable crystallizable compounds tend to be soluble in nonaqueous liquid carriers; thus, inclusion of a soluble component in the otherwise dispersed D portion may be expected to adversely impact solubility characteristics of the copolymer, particularly by increasing solubility of the D portion to the point where a relatively high viscosity solution polymer, rather than a relatively low viscosity dispersion polymer (organosol), is obtained.

Baker et al. (6,649,316, hereafter the “Baker ‘316 patent”) describes a phase change developer comprising: (a) a carrier having a Kauri-Butanol number less than 30; and (b) an organosol comprising a graft (co)polymeric steric stabilizer covalently bonded to a thermoplastic (co)polymeric core that is insoluble in said carrier, and said (co)polymeric steric stabilizer comprises a crystallizing polymeric moiety that independently and reversibly crystallizes at or above 30°C, wherein said phase change developer has a melting point at or above 22°C.

The Baker ‘316 patent describes a toner that is solid under storage conditions. As noted in the specification of the Baker ‘316 patent beginning at column 11, line 52, the term “phase change developer” has an accepted meaning within the imaging art. As the term indicates, the developer system is present as one physical phase under storage conditions (e.g., usually a solid) and transitions into another phase during development (usually a liquid phase), usually under the influence of heat or other directed energy sources. Thus, in the system as described in the Baker ‘316 patent, the toner is converted from a solid form to a liquid form prior to development, so that the toner as described first is in the solid form, and then through a specific manipulation is converted to liquid form under image formation conditions so that the actual image formation process is carried out in the form of a liquid. See column 2, lines 21-25. The Baker ‘316 patent therefore does not teach or suggest a liquid toner as presently claimed.

Moreover, the Baker ‘316 patent describes inclusion of a crystallizing polymeric moiety in the (co)polymeric steric stabilizer (see Abstract, Column 5, lines 3-6). The graft stabilizer (also referred to as the “shell” in the Baker ‘316 patent, see column 4, lines 64-67) “should have a Hildebrand Solubility Parameter closely matching that of the carrier to ensure that the stabilizer will be sufficiently solubility [sic] in the carrier when

the carrier is in its liquid state” (see column 5, lines 23-28). The Baker ‘316 patent states, “Improved blocking resistance is observed when the PCC is a major component of the graft stabilizer, preferably greater than 45% by weight of the graft stabilizer is the PCC, more preferably greater than or equal to 75%, most preferably greater than or equal to 90%” (see column 6, lines 47-51). The Baker ‘316 patent therefore does not teach or suggest a toner composition that includes one or more polymerizable, crystallizable compounds in the D material portion as presently claimed.

With respect to the Tg of the “polymeric core” of the Baker ‘316 patent, the patent states,

The composition of the insoluble resin core is preferentially manipulated such that the resin core exhibits a low glass transition temperature (Tg) that allows one to formulate a developer composition containing the resin as a major component to undergo rapid film formation (rapid self-fixing) in printing or imaging processes carried out at temperatures greater than the core Tg, preferably at or above 23°C. Rapid self-fixing assists in avoiding printing defects (such as smearing or trailing-edge tailing) and incomplete transfer in high speed printing. The core Tg of [sic] should be below 23°C, more preferably less than 10°C, most preferably less than -10°C.

(column 8, lines 21-32). The Baker ‘316 patent therefore does not teach or suggest a toner composition that comprises an amphipathic copolymer having a D material portion with a glass transition temperature greater than 55°C (claims 12, 22, 27) or in the range of 30°C to 50°C (claim 16) as presently claimed.

The Li et al. patent (6,103,781, hereafter the “Li ‘781 patent”) does not cure the deficiencies noted for the Baker ‘316 patent.

The Li ‘781 patent describes liquid ink compositions containing organosols having side-chain or main-chain crystallizable polymeric moieties (see Abstract). The binder resin of the Li ‘781 patent is an amphipathic copolymer (also known as an organosol) composed of a high molecular weight (co)polymeric steric stabilizer covalently bonded to an insoluble, thermoplastic (co)polymeric core. The crystallizable polymeric moiety is present in the steric stabilizer (see column 4, at lines 8-10, lines 26-30, and lines 57-62; column 6, lines 53-60). Similar to the Baker ‘316 patent, the Li ‘781

patent states teaches that improved blocking resistance is observed when the polymerizable crystallizable compound is a major component of the graft stabilizer (see column 8, lines 44-48). The Li '781 patent therefore does not teach or suggest inclusion of a polymerizable, crystallizable compound in the D material portion of an amphipathic copolymer as presently claimed.

With respect to the Tg of the "insoluble resin core" of the Li '781 patent, the patent states,

Organosols with core Tg's above room temperature (22°C) typically do not form cohesive films resulting in poor image transfer in offset printing. The integrity of the tone image during partial removal of the solvent also depends upon the core Tg, with lower Tg, promoting film strength and image integrity at the cost of additional image tack. An organosol core Tg below room temperature is preferred to ensure that the toner will in fact film form. Preferably, the minimum film forming temperatures are between about 22-45°C and the organosol core Tg is below room temperature to allow the toner to form a film and maintain good image integrity during solvent removal and good cohesive strength during image transfer from the photoconductor onto either a transfer medium or receptor.

(Column 11, lines 18-31)

Li '781 patent further states,

For liquid electrographic (electrostatic) toners, particularly liquid toners developed for use in direct electrostatic printing processes, the composition of the insoluble resin core is preferentially manipulated such that the organosol exhibits an effective glass transition temperature (Tg) of between 15-55°C, more preferably between 25-45°C.

The organosol core comprises approximately 30-95% of the organosol on a weight basis. Thus, the core's Tg will typically dominate over the stabilizer's Tg and the organosol Tg may be taken as a first approximation to be the core Tg.

(Column 11, lines 46-56)

The Li '781 patent does not teach or suggest liquid toner compositions comprising an amphipathic copolymer wherein the D material portion has a Tg greater than 55°C (claims 12, 22, 27). Nor does the Li '781 patent teach or suggest liquid toner

compositions comprising an amphipathic copolymer wherein the D material portion has a T_g in the range of 30°C to 50°C and wherein one or more polymerizable, crystallizable compounds are incorporated into the D material portion, or both the S material portion and the D material portion (claim 16). To the extent a polymerizable crystallizable compound is included in the binder resin of the Li '781 patent, it is included in the steric stabilizer only (see column 4, at lines 8-10, lines 26-30, and lines 57-62; column 6, lines 53-60; column 8, lines 44-48).

Applicant submits a *prima facie* case of obviousness is not established, since there is no suggestion or motivation to combine teachings, and even if one of skill in the art were to combine the teachings of the above-described references, he or she would not achieve the claimed invention.

The skilled artisan would have had no motivation to prepare a toner composition of the present claims, which surprisingly provide compositions through the inclusion of polymerizable crystallizable compound in the D portion (claims 1, 17, 23, and 25) or through selection of the T_g of components in the D material portion and inclusion of polymerizable crystallizable compound in the amphipathic copolymer (claims 12, 22, 27 and 16) that are particularly suitable for electrophotographic processes wherein the transfer of the image from the surface of a photoconductor to an intermediate transfer material or directly to a print medium is carried out without film formation on the photoconductor.

Furthermore, the skilled artisan could not have expected that such toner compositions would exhibit exceptional storage stability, excellent image transfer, and superior final image properties relative to erasure resistance and blocking resistance. As discussed herein, the skill artisan would not expect to be able to include the polymerizable, crystallizable compound in the D portion of the amphipathic copolymer without adversely affecting the properties of the amphipathic copolymer. Additionally, one would not have predicted that images made using the compositions as presently claimed would be surprisingly non-tacky and resistant to marring and undesired erasure.

Even if one of skill in the art were to combine the teachings of the Baker '316 patent and the Li '781 patent, he or she would not achieve the claimed invention, since

the references, alone or in combination, do not teach or suggest each of the claim limitations. There is no teaching or suggestion of at least the following elements of the claims: inclusion of one or more polymerizable, crystallizable compounds in the D portion of the amphipathic copolymer; amphipathic copolymers having D material portions with calculated Tg of greater than 55°C; and/or amphipathic copolymers having D material portions with calculated Tg in the range of 30°C to 50°C and having one or more polymerizable, crystallizable compounds incorporated into the D material portion, or both the S material portion and the D material portion.

For at least these reasons, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 1-29 under 35 U.S.C. §103.

Conclusion

In view of the above remarks, it is respectfully submitted that the foregoing is fully responsive to the outstanding Office action. In the event that a phone conference between the Examiner and the Applicants' undersigned attorney would help resolve any issues in the application, the Examiner is invited to contact said attorney at (651) 275-9836.

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Respectfully Submitted,

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